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Global electron identifier for CBM using Machine Learning approach

The Compressed Baryonic Matter (CBM) experiment is an upcoming fixed target experiment being built at the Facility for Anti-proton and Ion Research (FAIR).
The CBM experiment is designed to characterize the QCD medium at high net baryon densities and moderate temperatures.
Di-electrons interact electromagnetically and are unaffected by strong medium effects.
Hence, they are used as a penetrating probe to understand the QCD medium produced in the initial stages of heavy-ion collisions.
The identification of electrons with minimal pion contamination is crucial for these kinds of investigations.
The CBM experiment uses a Ring Imaging Cherenkov detector (RICH) in combination with a Transition Radiation Detector (TRD) for electron-pion separation, and a Time of Flight
(TOF) detector for identification of other high-mass hadrons.

The current RICH reconstruction algorithm employs an Artificial Neural Network (ANN) as a conventional electron identifier, which utilizes ring and track parameters as inputs.
In a recent upgrade, a new XGBoost model was implemented, adding additional input features, replacing the conventional ANN.
The output of the RICH XGBoost model serves as a probability measure for selecting electrons.
Similarly, TRD and TOF have their own measures for the electron identification.
Currently, a global electron identifier using the information from RICH, TRD, and TOF is developed using tree-based ensemble models.
A momentum independent training strategy is used to train the model, as it is foreseen to work for different collision energies (Au-Au systems up to 11 AGeV beam energy) and centralities.

This contribution will focus on the design aspects and performance analysis of the global electron identifier model with corresponding feature optimization.

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Category

Experiment

Collaboration (if applicable)

CBM

Primary author: SUBRAMANI, Pavish

Presenter: SUBRAMANI, Pavish

Track Classification: Electromagnetic probes